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somewhat dubious upon the account of the irregular Refractions.

March 23. 1721.

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IX. *A Proposal for measuring the height of Places, by help of the Barometer of Mr. Patrick, in which the Scale is greatly enlarged. By the same.*

SINCE *Torricelli* first found that the *Mercury* in an inverted Tube was in *Æquilibrio* with the whole Column of Air that was over it, and that the weight of the incumbent Column was various according to the different Dispositions of the Air, in respect of serene fair Weather, and of rainy, windy, or otherwise tempestuous Weather: there have been several attempts and contrivances to make the minute variations thereof more sensible. And first the Wheel Barometer was thought of, which certainly shews these variations with great exactness, but is only proper for a fixt Station, nor easy to be removed; which Circumstance is required for the principal use this Instrument is applicable to, and which I would recommend it for.

The next thought for this purpose was that of Mr. *Hubin*, described in *Phil. Trans.* N<sup>o</sup> 184, who returning the Tube of the Barometer, as an inverted Syphon, made a large dilatation in the ascending Leg thereof, wherein the *Mercury* ascended, as its Altitude in the other part thereof abated, and *à contra*: over this he drew out a narrow Glass Cane, which he fill'd with a tinged Spirit, and which being about fifteen times lighter

lighter than *Mercury*, would ascend about 15 times as much as the *Mercury* in the Barometer fell. This, besides that the Spirit would dilate and contract itself with heat and cold, had the inconvenience of the former, not to be easily removed without great danger of disorder and breaking, by reason of the smallness of the Tube in which the Spirit was to rise and fall.

This was succeeded by Dr. *Hook's* Marine Barometer, made of two Thermometers, the one the common seal'd Weather-glass, having no Communication with the outward Air, wherein the temper as to Heat and Cold was shewn by the swelling or shrinking of the included Spirit; the other the old Thermometer made with an inverted Bolt-head, in whose globular part was included Air somewhat rarer than the ambient, so as to make the Liquor which was to rise and fall in the shank of the Bolt-head, always to stand above the surface of the *Stagnum*, into which its end was immersed. This shew'd the heat of the Air by its own Dilatation; but at the same time, the different pressure of the Atmosphere mixed with it, so that the graduation of these two Thermometers being adjusted to any given height of the *Mercury*, they would at all times when the *Mercury* was at that height, both shew the same degree of heat: But at other times when the weight of the Air was different, that difference would shew itself by the disagreement of the degree of Heat shewed by them. This will be better understood from N<sup>o</sup> 269, of the *Transactions*, wherein I have described this Instrument at large. This, tho' of admirable use at Sea, to give timely notice of approaching bad Weather, labours under the Objection that it supposes the Concave of the Tubes of the Thermometers to be Cylinders, or of equal Diameters throughout; and also that on account of Heat and Cold the Air and Spirit have a

proportional Dilatation and Contraction ; the first of which I take to be very hard to be found in ordinary Glass Canes, and the other I fear still wants to be made out by authentick Experiments.

The last contrivance for this purpose, is that of Mr. *Patrick*, who styles himself the *Torricellian Operator*, by filling a small Glass Cane about five Foot long, and somewhat, but as little as may be, tapering upwards towards the close end of the Cane ; then inverting it, without a stagnant cistern of *Mercury*, so much of the *Mercury* as exceeds the length of the Column the Atmosphere can then support, will drop off, and leave its length equal to the then present height of the common Barometer : now when the Barometer rises, this length in the Cane becomes greater by the *Mercury's* being prest up into the upper and narrower part of the Tube ; and when it falls, on the contrary, it settles down into the wider part thereof, and becomes shorter, being always the same in Quantity. By this means, as the Angle of the Concave Cone of Glass, of which this Tube consists, is smaller, the different situation of the *Mercury*, will, upon the alteration of the Airs pressure, be nicely shewn by very large and distinct divisions.

Now the use I would apply this contrivance of the Barometer to, is to measure by it the different Levels of Places too remote to be come at by the ordinary Instruments for levelling, with the certainty one would desire. For this purpose let there be provided two small Glass Canes, as near as can be similar, growing very little taper or smaller at the closed end, so that being inverted, the *Mercury* may be suspended in them at the height it ought to have at the time of the Experiment. Let that height be duly noted, and then ascending the Monument, or some such Edifice where the ascent may be exactly measured, let the Scales  
annexed

annexed be divided into Parts by the descent of the *Mercury*, at every ten Foot, in both the pendent Barometers, which I conceive may be so chosen as to make the Divisions very distinct and sensible. These thus prepared, when it is desired to take the Level of two distant Places, let one of them be placed in the lower Place, at a time when the *Mercury* has the same height as when they were first inverted and graduated; and let the other be carried to the higher Place, where it will be found to stand at that division which answers the elevation of that Place above the other, the which had before been found by measure in ascending the Monument. Thus may 90 Foot ascent, which makes but one tenth of an Inch of *Mercury*, be represented by two or three Inches, or a space capable of being divided into 90 Parts: Whereas, if the distance of the two Places be 20 Miles, a minute of a Degree is equal to above 30 Foot; and by the usual Sights, whether Telescope or otherwise, of your Water Levels, I fear it will be very hard to convey a true Level without a greater Error than one Minute in the whole. This Proposal I humbly submit to the Examination of this Honourable Society.

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